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ABDOMINAL OBESITY CORRELATION OF C-PEPTIDE AND INSULIN RESISTANCE AMONG YOUNGER POPULATIONS

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Introduction. Abdominal obesity (AO) has emerged as a major public health concern and is increasingly recognized as a central driver of chronic low-grade systemic inflammation. This inflammatory state is primarily mediated by insulin resistance and the excessive release of pro-inflammatory factors resulting from the expansion and dysfunction of adipose tissue [1,2]. In this context, visceral adipose tissue is considered a metabolically active organ that plays a pivotal role in linking metabolic dysregulation with cardiovascular disease. Given the growing global prevalence of AO, including among younger populations [3], this condition represents a significant contributor to the burden of comorbid metabolic and cardiovascular disorders. Increasing evidence suggests that alterations in adipokine secretion and signaling are critically involved in the pathogenesis of cardiometabolic diseases and their associated complications [4–6]. Dysregulated adipokine profiles have been shown to promote endothelial dysfunction, chronic inflammation, and metabolic impairment, thereby accelerating disease progression.In our previous studies, we demonstrated significant associations between circulating adipokine levels and coronary artery disease (CAD) [7], arterial hypertension (AH) as well as hypercholesterolemia, underscoring the systemic impact of adipokine imbalance across multiple organ systems. Despite growing evidence, the role of adipokines in the pathogenesis of comorbid conditions remains poorly elucidated. Therefore, the present study aimed to characterize circulating adipokine profiles in young individuals with comorbid diseases

Keywords: C-peptide, young people, comorbid pathology, obesity, interleukin-6, aterosclerosis

Materials and Methods

A cross-sectional population-based study was conducted among residents of Andijan aged 25–44 years Local Ethics Committee protocol. The study sample comprised 500 participants, including 49% men. Written informed consent for participation and personal data processing was obtained from all individuals.Four pathological conditions were selected to define comorbidity in young adults: coronary artery disease (CAD), arterial hypertension (AH), , elevated low-density lipoprotein cholesterol (LDL-C) and type 2 diabetes mellitus (T2DM). Comorbid pathology was identified in 80 participants. A comparison group of conditionally healthy individuals without any of the listed conditions was formed and included 92 participants. Abdominal obesity was defined according to waist circumference thresholds of ≥94 cm in men and ≥80 cm in women. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). BMI categories were classified as normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), obesity class I (30.0–34.9 kg/m^2), class II (35.0–39.9 kg/m^2), and class III (morbid obesity; ≥40.0 kg/m^2).Arterial hypertension was diagnosed when systolic blood pressure (SBP) was ≥140 mmHg and/or diastolic blood pressure (DBP) was ≥90 mmHg. Coronary artery disease was assessed using epidemiological criteria, including the G.A. Rose questionnaire and electrocardiographic evaluation based on the Minnesota Code.

Type 2 diabetes mellitus (T2DM) was diagnosed based on epidemiological criteria at fasting plasma glucose levels ≥ 7.0 mmol/L and/or in individuals with normoglycemia and a documented medical history of previously diagnosed T2DM [14].

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Plasma levels of C-peptide (ng/mL), glucose-dependent insulinotropic polypeptide (GIP, pg/mL), glucagon (pg/mL), interleukin-6 (IL-6, pg/mL), insulin (pg/mL), and tumor necrosis factor-alpha (TNF-α, pg/mL) were measured using multiplex analysis on a MILLIPLEX® analyzer (Merck Millipore, USA) with the Human Metabolic Hormone V3 panel (MILLIPLEX®). Adiponectin concentrations (μg/mL) were determined using the Human Adipokine Magnetic Bead Panel 1.

Statistical analyses were performed using SPSS software (version 13.0). Due to the non-normal distribution of most continuous variables, data are presented as median and interquartile range, Me (Q25; Q75). Categorical variables are expressed as absolute and relative frequencies, n (%). Differences between two independent groups were assessed using the Mann–Whitney U test, while comparisons of proportions were performed using Pearson's χ^2 test. Associations were evaluated by multivariable logistic regression analysis. Results of logistic regression are presented as odds ratios (ORs) with 95% confidence intervals (95% CI). A two-sided p-value < 0.05 was considered statistically significant.

Results

In the structure of comorbid pathology, elevated low-density lipoprotein cholesterol (LDL-C) was the most prevalent condition, observed in 101 individuals (96.2%), followed by arterial hypertension (AH) in 83 participants (79.0%). Type 2 diabetes mellitus (T2DM) was identified in 17 individuals (16.2%), and coronary artery disease (CAD) in 16 individuals (15.2%).Among men with comorbid pathology, plasma levels of interleukin-6 (IL-6) were significantly higher compared with conditionally healthy men (5.1 [1.3–7.5] vs 0.9 [0.4–1.5], p = 0.0001). Higher concentrations of C-peptide (0.9 [0.4–1.7] vs 0.3 [0.1–0.8], p = 0.0001) and insulin (584.5 [390.4–1062.5] vs 406.9 [291.0–614.1], p = 0.014) were also observed, while peptide (PYY) levels were significantly lower (45.1 [34.5–63.5] vs 69.2 [44.6–118.6], p = 0.010).In women with comorbid pathology, plasma IL-6 levels were significantly elevated compared with conditionally healthy women (2.1 [1.3–6.3] vs 0.6 [0.3–1.2], p = 0.0001). In addition, higher tumor necrosis factor-alpha (TNF-α) concentrations were detected (5.7 [3.5–8.4] vs 4.0 [2.5–6.0], p = 0.009).

Analysis of adipokine and hormone levels in participants with different combinations of pathological conditions revealed significant differences for IL-6, insulin, PYY, and C-peptide. Individuals with a combination of AH, T2DM, and elevated LDL-C demonstrated 1.7-fold higher C-peptide levels and 2.1-fold higher insulin levels compared with other participants with comorbid pathology. In participants with AH and T2DM, plasminogen activator inhibitor-1 (PAI-1) levels were 1.5 times higher. Participants with AH, elevated LDL-C, and CAD exhibited 1.3-fold higher C-peptide concentrations, whereas those with AH and elevated LDL-C showed 1.5-fold lower interleukin levels compared with other individuals with comorbid pathology.
Among participants with reduced renal function and elevated LDL-C, insulin levels were 1.4 times lower than in other individuals with comorbid pathology. PYY concentrations were also reduced in participants with combinations of elevated LDL-C and CAD (1.6-fold decrease) compared with other comorbid groups (Table 1).

Table 1. Plasma levels of inflammatory markers, hormones, and adipokines in participants with comorbid pathology and conditionally healthy controls, stratified by sex

Women

Parameter	Comorbid pathology	Conditionally healthy	*p*-value
IL-6 (pg/mL)	2.1 (1.3–6.3)	0.6 (0.3–1.2)	| 0.0001
TNF-α (pg/mL)	5.7 (3.5–8.4	4.0 (2.5–6.0)	0.009

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C-peptide is widely used as a marker of endogenous insulin secretion and serves as a valuable tool for the diagnosis and monitoring of metabolic disturbances, particularly insulin resistance. Obesity itself is recognized as an independent risk factor for elevated C-peptide levels. The interaction between increased insulin secretion and excess adiposity may contribute to the formation of a vicious cycle, ultimately leading to the development of metabolic syndrome and an increased risk of cardiometabolic diseases. The findings of the present study support the presence of independent associations between elevated C-peptide levels and comorbid pathology.It is well established that interleukin-6 (IL-6) plays a central role in the development of chronic low-grade inflammation, which is closely linked to metabolic disorders such as insulin resistance and obesity. Accordingly, elevated IL-6 levels associated with comorbid pathology in young adults were anticipated. However, when peptide(PYY) was included in the regression model, the statistical significance of this association was attenuated, similar to the effect observed for resistin.PYY is secreted in response to food intake and contributes to appetite suppression, thereby playing a critical role in the pathogenesis of obesity and metabolic disorders. In young individuals with obesity, dysregulation of PYY secretion may occur, leading to increased food consumption and subsequent weight gain . In addition to its metabolic effects, PYY is involved in the regulation of inflammatory processes, as it interacts with immune cells and may reduce the secretion of proinflammatory cytokines. Previous studies have demonstrated that lower PYY levels may correlate with increased concentrations of inflammatory markers, including IL-6 and TNF-α, indicating a link between PYY and chronic inflammation.I n the present study, lower PYY levels were observed in individuals with comorbid pathology. Moreover, the independent association between reduced PYY concentrations and the presence of comorbid conditions in young adults suggests that alterations in this marker may play a substantial role in the development of metabolic disturbances.

Discussion

This population-based investigation demonstrates that young adults with comorbid conditions exhibit substantial changes in inflammatory and metabolic biomarker profiles, indicating early onset of systemic metabolic and inflammatory imbalance. The predominance of elevated low-density lipoprotein cholesterol and arterial hypertension among comorbid conditions supports the concept that cardiometabolic risk processes may begin early in life.Consistently higher concentrations of interleukin-6 (IL-6) were observed in both male and female participants with comorbid pathology. As a central mediator of chronic low-grade inflammation, IL-6 is closely involved in mechanisms underlying insulin resistance, endothelial dysfunction, and atherosclerotic processes. The presence of elevated IL-6 levels in young adults may therefore reflect early inflammatory activation associated with the accumulation of cardiometabolic risk factors, as described in previous studies.Pronounced sex-related differences in biomarker patterns were evident. Among men with comorbid pathology, increased C-peptide and insulin levels accompanied by reduced peptide (PYY) concentrations point to disturbances in glucose regulation and potential impairment of appetite control. Elevated C-peptide and insulin likely represent compensatory responses to insulin resistance, whereas lower PYY levels may weaken satiety signaling and contribute to ongoing metabolic dysregulation. In contrast, women with comorbid pathology showed higher tumor necrosis factor-alpha (TNF-α) concentrations, suggesting a stronger inflammatory component, possibly influenced by sex-specific endocrine and immune factors.

Evaluation of biomarker profiles across various combinations of pathological conditions revealed marked heterogeneity in metabolic alterations. The greatest elevations in C-peptide and insulin were detected in individuals with concurrent arterial hypertension, type 2 diabetes mellitus, and elevated LDL-C, indicating more advanced insulin resistance. Increased plasminogen activator inhibitor-1 (PAI-1) levels in participants with arterial hypertension and

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type 2 diabetes mellitus may reflect heightened prothrombotic activity, consistent with the elevated cardiovascular risk observed in these individuals.Reduced insulin levels in participants with impaired renal function and elevated LDL-C may be attributable to altered insulin metabolism or more advanced metabolic disturbances. Furthermore, lower PYY concentrations in individuals with combined elevated LDL-C and coronary artery disease further support an association between increasing cardiometabolic burden and dysregulation of gut-derived hormonal pathways. Several limitations should be considered. The cross-sectional nature of the study limits causal interpretation, and the relatively small sample sizes within certain comorbidity subgroups may have reduced statistical power. Additionally, potential confounding factors such as dietary patterns and physical activity were not assessed. Despite these limitations, the population-based design and extensive biomarker profiling represent important strengths.

In conclusion, the present findings indicate that comorbid conditions in young adults are associated with specific inflammatory and metabolic abnormalities, characterized by distinct sex-related patterns. Early detection of these subclinical changes may be essential for the development of effective preventive strategies aimed at mitigating future cardiometabolic risk

Conclusion

In this population-based study, comorbid pathology in young adults was associated with early and distinct inflammatory and metabolic alterations. Elevated levels of IL-6, C-peptide, insulin, and TNF-α, along with reduced peptide YY concentrations, indicate the coexistence of low-grade inflammation, impaired glucose regulation, and disrupted appetite-related signaling at a young age.Notably, sex-specific differences in biomarker profiles were observed, underscoring the heterogeneity of metabolic responses in comorbid conditions. The independent associations of increased C-peptide and decreased peptide YY with comorbid pathology suggest that these biomarkers may represent early indicators of metabolic dysregulation in young populations. Taken together, these findings highlight the importance of early identification of subclinical inflammatory and metabolic changes. Such an approach may support the development of targeted preventive and diagnostic strategies aimed at reducing long-term cardiometabolic risk in young adults.

References.

1. Banu S., Jabir N.R., Manjunath C.N., Shakil S., Kamal M.A. C-peptide and its correlation to parameters of insulin resistance in the metabolic syndrome. CNS Neurol. Disord. Drug Targets, 2011; 10 (8): 921–927. doi: 10.2174/187152711799219271
2. Carbone S., Canada J.M., Billingsley H.E., Siddiqui M.S., Elagizi A., Lavie C.J. Obesity paradox in cardiovascular disease: where do we stand? Vasc. Health Risk Manag., 2019; 15: 89–100. doi: 10.2147/ VHRM.S168946
3. Chait A., den Hartigh L.J. Adipose tissue distribution, inflammation and its metabolic consequences, including diabetes and cardiovascular disease. Front. Cardiovasc. Med., 2020; 7: 22. doi: 10.3389/fcvm.2020.00022
4. Chan J.L., Stoyneva V., Kelesidis T., Raciti P., Mantzoros C.S. Peptide YY levels are decreased by fasting and elevated following caloric intake but are not regulated by leptin. Diabetologia, 2006; 49: 169– 173. doi: 10.1007/s00125-005-0041-2
5. Dutheil F., Gordon B.A., Naughton G., Crendal E., Courteix D., Chaplais E., Thivel D., Lac G., Benson A.C. Cardiovascular risk of adipokines: a review. J. Int. Med. Res., 2018; 46 (6): 2082–2095. doi: 10.1177/0300060517706578
6. Ha E.E., Bauer R.C. Emerging roles for adipose tissue in cardiovascular disease. Arterioscler. Thromb. Vasc. Biol., 2018; 38 (8): e137–e144. doi: 10.1161/ATVBAHA.118.311421

pISSN:2349-5707 Volume:12,Issue 12,December-2025 eISSN:2349-5715

7. Khudiakova A.D., Polonskaya Ya.V., Shcherbakova L.V., Shramko V.S., Kuzminykh N.A., Kashtanova E.V., Ragino Yu.I. Associations of circulating adipokines and coronary artery disease in young adults. Cardiovascular Therapy and Prevention, 2024; 23 (5): 3965. (In Russ.)]. doi: 10.15829/1728-8800-2024-3965